

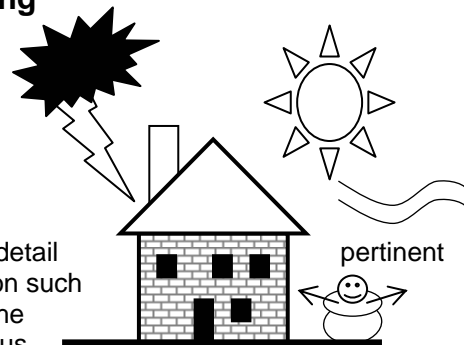


Minnesota State Residential Energy Code Requirements

The Energy Code provides minimum standards for permitting energy efficient operation, assuring building durability and furnishing quality indoor air.

It gives us minimum standards for insulation and other components that helps our buildings perform when the weather changes.

Plans and specifications. Plans and specifications shall show in sufficient detail data and features of the building, the equipment, and other design information such as: exterior envelope component materials and their locations, U-factors of the envelope systems, R-values of insulating materials, size and type of apparatus and equipment, equipment and system controls, and other relevant information.



This handout is a guide based on the Minnesota State Residential energy Code, Chapter 1322 of the MN State Building Code. Refer to the entire MN Residential Energy Code for specific rules, available online: <https://www.revisor.mn.gov/rules/?id=1322>

Two important terms to remember when starting your project, which are listed with the product:

- **R-Value**—the thermal resistance, it is related to the thickness of the insulation that is installed, and it varies, depending upon the type of insulation being used. The higher the R-Value, the warmer it will keep your house.
- **U-Factor**—also called U-Value, it is the thermal conductivity. Commonly used to measure window energy efficiency. The lower the number, the better it is for energy conservation.

The following are some of the basic requirements* of the MN State Residential Energy Code, Chapter 1322, to be used as a general guide:

(see Tables N1102.1 and N1102.1.2 for complete information.)

- ☐ **Ceiling:** R-44, minimum
- ☐ **Wood Framed Wall:** R-19, minimum
- ☐ **Floor:** R-30, minimum
- ☐ **Foundation Wall:** R-10, minimum
- ☐ **Rim Joist:** R-10, minimum
- ☐ **Slab:** R-10, to a depth of 5' below grade. An additional R-5 is required at perimeter vertical edge of heated slabs. If frost protected shallow foundation design is used, total vertical + horizontal insulation must equal 60 inches
- ☐ **Crawl Space Wall:** R-10, minimum
- ☐ **Mass Wall:** R-15, minimum
(above grade, concrete block, concrete, ICF, masonry cavity brick, earth logs)
- ☐ **Fenestration** (windows and doors): U-.35, maximum
- ☐ **Skylights:** U-.60, maximum

EXTERIOR ENVELOPE COMPONENTS:

- **Below Grade Vapor and Soil-Gas Retarder** *Impedes the flow of soil gases into the building.*
 - *6mil polyethylene is a minimum requirement for under-slab locations, with seams lapped 12".*
 - *See Radon handout for additional requirements.*
- **Exterior Wall Vapor Retarder** *Prevents diffusion of moisture into wall cavities.*
 - *Required on warm side of walls, ceilings and floor rim joist areas.*
 - *4 mil polyethylene used as interior air barrier also serves as vapor retarder if sealed.*
- **Interior Air Barrier** *Prevents leakage of moisture laden air into the building envelope.*
 - *Required continuous on warm side of insulated ceilings, walls and at floor rim joist shall be sealed.*
 - *NOT required at concrete wall insulation or window, door and skylight rough openings*
 - *Penetrations must be sealed*
 - *4 mil polyethylene used as vapor barrier also serves as air barrier if sealed*
- **Exterior Wind Wash Barrier** *Prevents the intrusion of outdoor airborne moisture and water into building envelope. Typically, this term is referred to as a house wrap or a building felt.*
 - ***Shall be installed:***
 - *Between attached garage and interior conditioned spaces (tightly fit), and*
 - *At the exterior edge of the exterior wall top plate extending vertically to the underside of the truss top cord, or for non-truss wood framing to within 3-1/2" of the roof deck, or to the top of the ceiling insulation (tightly fit), and*
 - *At all exterior walls and all rim joist areas (tightly fit), and*
 - *At all cantilevers, cantilevered rims, and floors over unconditioned spaces (sealed).*
 - *Shall be sealed to prevent the intrusion of water and airborne moisture.*
 - *Can be rigid or flexible unless specified.*
- **Slab on Grade Floors**
 - *Continuous perimeter insulation from top of slab to frost line or to bottom of slab then horizontally for a total distance equal to the design frost line (60 inches)*
 - *Horizontal insulation less than 12" below grade or extending more than 24 inches from foundation must be protected from damage by covering with below grade plywood placed on top of the insulation, or other approved method.*
- **Foundation Walls**
 - *Insulation required from top of wall to the top of the footing*
 - *Where foundation insulation is on the exterior, a rigid coating finish or protection board is required from the top of the insulation to 6 inches below grade to protect insulation from sun and physical abuse.*
 - *Where foundation insulation is interior with rigid insulation or framed walls, locate waterproofing between the insulation and the foundation wall. See specific rules, per N1102.2.6 regarding interior foundation insulation.*
- **Loose Fill Attic Insulation**
 - *Insulation I.D. must be provided and thickness markers or tags from bags attached to the attic card.*
 - *Attic insulation shall perform per the overall minimum R-Value requirements. A 12" energy heel is acceptable, if the edge condition is offset by additional insulation elsewhere, based on the performance of the entire roof assembly.*
 - *Install attic insulation thickness markers every 100sf, facing towards the attic access.*

Mechanical Systems:

- **Each heating and cooling system requires at least one thermostat as a control, per N1103.1.**
- **Ducts** shall be insulated, unless heat loss and gain is not an issue. See N1103.2.1 for specific requirements.
- **Ducts shall be sealed.** Refer to the table in the Residential Energy Code, regarding various locations and standards, as well as Chapter 1346 of the MN Mechanical Code.
- **Supply ducts** shall be continuously ducted according to the Minnesota Mechanical Code, chapter 1346, from the point of origin to the point of discharge in the habitable spaces. The building framing cavities and building components shall not be used as supply ducts.

N1103.2.4 Domestic water piping insulation. Pipe insulation shall have a k-value of 0.27. If the K-value of a product is less than 0.27, then the pipe thickness shall be adjusted to have an equivalent R-value.

A. Cold water piping: no insulation required.

Exception: All piping located within 6 inches of any heating pipes shall have a minimum of 1 inch insulation with an appropriate vapor jacket.

B. Hot water piping: no insulation required.

Exceptions:

1. All recirculating systems shall have a minimum of 0.5 inch insulation on the entire loop with an appropriate vapor jacket.
2. All underground piping shall have a minimum of 1 inch insulation with an appropriate vapor jacket.

N1103.2.5 HVAC Piping. Hydronic, steam, and condensate piping in all locations shall be insulated in accordance with the Minnesota Mechanical Code, chapter 1346.

Exceptions:

1. Piping installed within HVAC equipment.
2. Piping installed in basements, crawl spaces, and cellars.

Refer to Table N1103.2.4 for additional requirements, regarding insulation thickness over various pipes.

N1103.2.6 Equipment sizing. Heating and cooling equipment shall be sized per the Minnesota Mechanical Code, chapter 1346, and ACCA Manual J.

N1103.4 Domestic circulating hot water systems. Circulating hot water systems shall include an automatic switch that can turn the hot water circulating pump off when the system is not in use or when the circulating loop temperature is satisfied.

N1104.1 Mechanical ventilation requirements. A mechanical ventilation system shall be installed that meets the requirements of this section. This section covers the continuous and total mechanical ventilation requirements for dwelling unit ventilation at summer and winter climatic design conditions according to Section N1104.4.13 and chapter 1346. All unfinished basements, crawlspaces, and levels shall be provided with a minimum ventilation rate of 0.02 cfm per square foot, or a minimum of one supply duct and one return duct. The supply and return ducts shall be separated by one-half the diagonal dimension of the basement to avoid a short circuit of the air circulation.

Exception: Kitchen and bath fans that are not included as part of the mechanical ventilation system are exempt from the requirements of Section N1104 but shall comply with the IRC.

N1104.1.1 Additions or alterations to existing buildings. Additions or alterations to existing buildings shall require a dwelling unit mechanical ventilation system that meets Section N1104.

Exception: Buildings whose permit of initial construction was applied for prior to April 15, 2000, and did not require a dwelling unit mechanical ventilation system.

N1104.2 Total ventilation rate. The mechanical ventilation system shall provide sufficient outdoor air to equal the total ventilation rate average, for each one-hour period according to Table N1104.2, or Equation 11-1, based on the number of bedrooms and the square footage of conditioned space, including the basement but excluding conditioned crawl spaces. For heat recovery ventilators and energy recovery ventilators the average hourly ventilation capacity must be determined in consideration of any reduction of exhaust or outdoor air intake, or both, for defrost or other equipment cycling per HVI Standard 920.

Equation 11-1:

Total ventilation rate (cfm) = (0.02 x square feet of
conditioned space) +
[15 x (number of bedrooms + 1)]

N1104.2.1 Continuous ventilation. A minimum of 50 percent of the total ventilation rate, but not less than 40 cfm, shall be provided, on a continuous rate average for each one-hour period according to Table N1104.2 or Equation 11-2. The portion of the mechanical ventilation system that is intended to be continuous may have automatic cycling controls providing the average flow rate for each hour meeting the requirements of Section N1104.2.1.

Equation 11-2:

Continuous ventilation (cfm) = total ventilation rate/2

N1104.2.1.1 Ventilation rate. The continuous ventilation system shall be balanced in accordance with Section N1104.4.2.

Exception: If the local ventilation requirements according to IRC Section R303.3 are being met by the continuous ventilation system, it shall be capable of operating at a rate not more than 100 percent greater than required by Section N1104.2.1.

N1104.2.2 Intermittent ventilation. The difference between the total ventilation rate and the continuous ventilation rate shall be based on flow rates as designed or as installed.

Refer to Table N1104.2 in the Minnesota Residential Energy Code for required ventilation rates, based on the number of bedrooms and the amount of conditioned space.

N1104.3 Ventilation system requirements. The mechanical ventilation system shall be one of three types: exhaust according to Section N1104.3.1; balanced, and HRV/ERV according to Section N1104.3.2; or other method according to Section N1104.3.3.

N1104.3.1 Exhaust systems. Fans used to comply with the continuous ventilation part of the mechanical ventilation system shall:

1. meet the minimum continuous ventilation rate in Section N1104.2.1 at the point of discharge;
2. be designed and certified by the equipment manufacturer as capable of continuous operation at the rated cfm;
3. have a maximum 1.0 sone per HVI Standard 915 for surface mounted fans;
4. be permitted to use a required overcurrent protection device as a disconnect per the National Electric Code, incorporated by reference in Minnesota Rules, chapter 1315; and
5. comply with the Minnesota Mechanical Code, chapter 1346, which may require additional make-up air.

Fans used to comply with the intermittent ventilation part of the mechanical ventilation system shall have a maximum 2.5 sone per HVI Standard 915.

N1104.3.2 Balanced, and HRV/ERV systems. A heat recovery ventilator (HRV) or energy recovery ventilator (ERV) shall meet either:

1. the requirements of HVI Standard 920, 72 hours minus 13 degrees Fahrenheit cold weather test; or
2. certified by a registered professional engineer and installed per manufacturer's installation instructions.

An HRV or ERV intended to comply with both the continuous and total ventilation rate requirements shall meet the rated design capacity of the continuous ventilation rate in Section N1104.2.1 under low capacity and meet the total ventilation rate in Section N1104.2.2 under high capacity.

Exception: The balanced, and HRV/ERV system may include exhaust fans to meet the intermittent ventilation rate. Surface mounted fans shall have a maximum 2.5 sones per HVI Standard 915.

N1104.3.3 Other methods. Any mechanical ventilation system consisting of exhaust fans, supply fans, or a combination of both, complying with Section N1104, shall be allowed. A mechanical ventilation system specifically identified in Section N1104.3.1 or N1104.3.2 shall not conflict with Sections N1104.3.1 and N1104.3.2. For the purposes of this section, the delivered ventilation rate is the larger of the total air flow of the operating supply fans, or total air flow of the operating exhaust fans.

N1104.4 Installation requirements. All types of mechanical systems shall meet the requirements of this section. The mechanical ventilation system and its components shall also be installed according

to the Mechanical Code, Minnesota Rules, chapter 1346, and the equipment manufacturer's installation instructions.

N1104.4.1 Air distribution and circulation. Outdoor air shall be delivered to each habitable space by a forced air circulation system, separate duct system, individual inlets, or a passive opening.

N1104.4.1.1 Forced air circulation systems. When outdoor air is supplied directly through a forced air circulation system, the requirements of this section shall be met by either:

(a) when an outdoor air supply is not ducted to the forced air system, controls shall be installed to allow the forced air system to provide an average circulation flow rate each hour, of not less than 0.15 cfm per square foot of the conditioned floor area; or

(b) when the outdoor air supply is ducted to the forced-air system, it shall be tempered so that the mixed air temperature shall be no less than 60 degrees Fahrenheit or the heating equipment manufacturer's installation instruction, and controls shall be installed to allow the forced air circulation system to provide an average flow rate not less than 0.075 cfm per square foot of conditioned floor area.

N1104.4.1.2 Directly ducted and individual room inlets. When outdoor air is supplied directly to habitable spaces with an airflow of 20 cfm or greater, the system shall be designed and installed to temper incoming air to not less than 40 degrees Fahrenheit measured at the point of distribution into the space.

Refer to Table N1104.4.1 for indirect circulation air flow rates for forced-air circulation systems.

Refer to Table N1103.2.4 for direct air flow rates using forced-air circulation systems.

N1104.4.1.3 Passive openings. When outdoor air is brought in through a passive opening, the maximum cfm of the outdoor air requirements shall be combined with the maximum makeup air requirements of Minnesota Rules, chapter 1346. The combined air rates shall be brought into the dwelling unit in accordance with chapter 1346. Controls shall be installed to distribute air throughout the dwelling unit as required by Section N1104.4.1.1a.

N1104.4.2 Airflow verification. Mechanical ventilation system airflows greater than 30 cfm at the building exhaust or intake shall be tested and verified using a flow hood, flow grid, pitot tube, or other airflow measuring device. The airflow verification results shall be made available to the building official upon request.

N1104.4.2.1 Airflow requirements. When the system is intended to be unbalanced, the design supply air flow shall not exceed 0.05 cfm per square foot of conditioned space. The operating exhaust air flow shall meet the requirements of Section N1104.3.1 and the Minnesota Mechanical Code, chapter 1346, which may require additional makeup air. When the system is intended to be balanced, the exhaust and supply airflows shall be within plus or minus ten percent of each other or the manufacturer's installation instructions, whichever is more restrictive.

N1104.4.3 Fans. When used as part of the mechanical ventilation system, fans shall be capable of delivering the designed air flow as determined by Section N1104.2 according to HVI Standard 916. Fans shall be designed and certified by the equipment manufacturer as capable of continuous operation at the rated cfm. Surface mounted fans used to comply with the continuous ventilation part of the mechanical ventilation system shall have a maximum 1.0 sone per HVI Standard 915. Fans used to

comply with the intermittent ventilation part of the mechanical ventilation system shall have a maximum 2.5 sone per HVI Standard 915.

Exception: Some requirements do not apply to forced air circulation systems and remotely mounted fans, provided the remotely mounted fan is not in a habitable space and there is at least 4 feet of ductwork between the fan and the grille.

N1104.4.4 Multifan systems. When two or more exhaust fans in a dwelling unit share a common exhaust duct, each fan shall be equipped with a backdraft damper to prevent recirculation of exhaust air into another room.

N1104.4.5 Connection to forced air circulation systems. Air ducts connected directly to the forced air circulation system can be used to meet the mechanical ventilation system requirements. Either the tempered outdoor air may be supplied to, or exhaust air may be drawn from, the forced air circulation system, but not both.

Exception: Both outdoor air and exhaust air may be connected to the forced air circulation system, provided that controls are installed to ensure that the forced air circulation system is operating whenever the mechanical ventilation system is operating or other means are provided to prevent short circuiting of fresh air according to the manufacturer's recommendations.

N1104.4.6 Dampers. Mechanical ventilation system supply and exhaust ducts shall be provided with accessible backflow dampers to minimize flow to or from the outdoors when the ventilation system is off.

N1104.4.7 Intake openings. Exterior air intake openings shall be accessible for inspection and maintenance. Intake openings shall be located in accordance with the Minnesota Mechanical Code, chapter 1346, and shall be covered with corrosion resistant screen of not less than one-fourth inch (6.4 mm) mesh. Intake openings shall be located at least 12 inches (305 mm) above adjoining grade level.

Exception: Combination air intake and exhaust hoods may be approved by the building official when specifically allowed by the equipment manufacturer's installation instructions.

N1104.4.8 Filtration. Mechanically supplied outdoor air shall have a filter with a designated minimum efficiency of MERV 4 as defined by ASHRAE Standard 52.2. The filter shall be located prior to the air entering the thermal conditioning components, blower, or habitable space and shall be installed to be readily accessible and facilitate regular service.

N1104.4.9 Noise and vibration. Mechanical ventilation system components shall be installed to minimize noise and vibration transmission. The equipment manufacturer's installation instructions shall be followed, and materials provided by the equipment manufacturer shall be used for this purpose. In the absence of specific materials or instructions, vibration dampening materials such as rubber grommets and flexible straps shall be used when connecting fans and heat exchangers to the building structure, and isolation duct connectors shall be used to mitigate noise transmission.

N1104.4.10 Controls. Mechanical ventilation system controls shall be provided according to the following.

1. Controls shall be installed to ensure that the forced air circulation system is operating whenever the mechanical ventilation system is operating if required by the equipment manufacturer's installation instructions.

2. Controls shall be installed to ensure that whenever the mechanical ventilation system is operating, the forced air circulation system provides indirect circulation of 0.15 cfm per square foot of conditioned floor area or direct distribution of 0.075 cfm per square foot of conditioned floor area.
3. If the mechanical ventilation system is not designed to operate whenever the forced air circulation system is operating, the mechanical ventilation system shall incorporate an accessible backflow damper to prevent flow from the outside when the mechanical ventilation system is off.
4. Controls shall be compatible with the mechanical ventilation system.
5. Controls shall be installed to operate the mechanical ventilation system as designed.
6. Controls shall be readily accessible to occupants and shall be labeled to indicate their function.
7. If a switch is used for continuous ventilation, it can be located centrally or remotely, but shall not be located in a bath or toilet room. If centrally located, it shall be properly labeled and lighted when the system is on. If remotely located, there shall be a lighted status indicator in a central location that will be lighted when the system is on.

N1104.4.11 Labeling. The outdoor air intake and exhaust air outlet shall include a permanent, weather resistant identification label stating "OUTDOOR AIR INTAKE" or "EXHAUST AIR OUTLET" as appropriate. Controls provided for continuous and intermittent ventilation shall be provided with a label stating "VENTILATION SYSTEM" or "VENTILATION FAN" or "INTERMITTENT FAN" or ventilation symbols, as appropriate.

N1104.4.12 Documentation. Mechanical ventilation systems shall be provided with documentation that includes proper operation and maintenance instructions and a warning regarding potential problems if the system is not operated and maintained. A permanent warning label shall be affixed to a mechanical ventilation system if it is readily accessible. If the mechanical ventilation system is not readily accessible, the documentation shall be in a conspicuous readily accessible location.

N1104.4.13 Climatic design conditions.

A. HVAC equipment must be sized according to the 2005 ASHRAE Handbook of Fundamentals, ACCA Manual J, or an equivalent method. Oversizing of heating equipment must not exceed 43 percent and cooling equipment must not exceed 21 percent.

B. Design conditions must be determined from Table N1104.4.13. Design condition adjustments may be made as determined by the building official to reflect local climates that differ from the tabulated temperatures or local weather experience.

****The outdoor design conditions for Duluth are as follows:***

- ***Summer 81°Db, 67°Wb.***
- ***Winter -20°Db.***

*Db = dry bulb temperature, degrees Fahrenheit.

*Wb = wet bulb temperature, degrees Fahrenheit

See Radon Handout for radon design requirements.